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THE CHILD'S USE OF SENTENCE STRUCTURE TO ORGANIZE AND LEARN VERBAL MATERIAL

by

© JUDITH WIENER

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The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies for acceptance, a thesis entitled THE CHILD'S USE OF SENTENCE STRUCTURE TO ORGANIZE AND LEARN VERBAL MATERIAL submitted by Judith Wiener in partial fulfilment of the requirements for the degree of Master of Education.

ABSTRACT

How does a child organize his world so that he is capable of learning? This is the global question asked in the present thesis. The author attempted to find some answers to this question by asking a more specific question: how do children between the ages of 5 and 10 use the syntactic structure implicit in English sentences to organize and learn new verbal material?

Fifty-four children, 6 from kindergarten and 12 (6 boys and 6 girls) from each of grades 1 through 4, participated in the study. During the course of an individual testing session lasting approximately one-half hour, the children learned three sentences which were presented orally according to a trials to criterion procedure with a maximum of twenty trials. The sentences consisted of English function words and bound morphemes, content words constructed from nonsense syllables, and declarative intonation contour. The type 1 sentence maintained the syntactic cues of a grammatical English sentence-word order, intonation, and bound morphemes and function words. In the type 2 sentence the order of the words was re-arranged so that the result conflicted with common English usage, and the type 3 sentence lacked bound morphemes and function words. The oral responses

of the children were recorded.

A statistical treatment of the data revealed that sentence - type 3 was learned most rapidly, followed by type 1, and type 2 was most difficult to learn. The difference between type 1 and type 2 sentences was decreased for grade 1 students. After one or two trials, most children grasped the general structure of the sentence including intonation and word order, and then perfected individual words and phrases, showing the primacy and recency effects. Articulation, anticipation, and perseveration errors were common. Kindergarten and grade 1 children often replaced the nonsense words with similar English words, words (particularly function words) or phrases were frequently omitted in type 1 and 2 sentences, and bound morphemes were often attached to inappropriate words in type 2 sentences. In sum, the children, particularly those in grades 2, 3, and 4 tended to use the syntactic cues of word order and intonation to facilitate their learning of the sentences.

The following statements were substantiated in the thesis: Learning involves more than a particular reaction to a specific stimulus, more than an assimilation of environmental events. The learner, whether child or adult, must attend to, order, and organize, both the input and his own output. This occurs whether the learning is verbal or nonverbal (perceptual). The nature of the interaction between the learner and the object to be learned

(skill, concept, or fact) depends on the nature of the object and the developmental stage of the learner. This interaction is influenced by sensory, motivational, and cognitive factors, and by social and cultural factors.

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The help of the Edmonton Public School Board and the co-operation of the principal, Mr. A. Romaniuk and the staff of Lynnwood Public School is much appreciated. The author's gratitude toward the children is best expressed by the words of Frank S. Kessel (1970).

> The children, of course, constituted the true architects of the study, and I loved working with them. The psychologists supposedly scientific phrase "subjects" was never more of a misnomer, for these children, as much as any others, were subject to nothing more or less than the wondrous workings of their own minds.

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CHAPTER I

INTRODUCTION

Learning involves more than a particular reaction to a specific stimulus, more than an assimilation of environmental events. The learner, whether child or adult, must attend to, order, and organize, both the input and his own output. This occurs whether the learning is verbal or nonverbal (perceptual). The nature of the interaction between the learner and the object to be learned (skill, concept, or fact) depends on the nature of the object and the developmental stage of the learner. This interaction is influenced by sensory, motivational, and cognitive factors, and by social and cultural factors.

The purpose of this thesis is to elaborate on and substantiate the above statements, and to illustrate them by describing how children ranging in age from 5 to 10 years use the syntactic cues implicit in the English language to organize the learning of verbal material. This is accomplished by a review of some of the literature pertaining to this topic, and by a developmental study.

The review of the literature is in two parts. The first section is concerned with the above general statements. Since it is not possible to discuss all the theories and empirical data pertaining to this topic, only information

crucial to the development of the thesis is presented. Theories and studies from the literature on perception and language development are used as illustrations of how people organize stimuli and their own actions. This evidence is supported by some physiological data, and is placed in a developmental perspective in order to elucidate what qualitative shifts occur at various levels. The second part of the review is a more complete discussion of the literature related to the study.

This thesis was to a certain extent inspired by the author's work with children of at least average intelligence who have learning disabilities related to perceptual-motor and/or language difficulties. Clinicians have often observed that a large number of these children seem unable to impose an order on external stimuli or to easily cope with organization and structure. They appear to be generally disoriented and disorganized. Perception, language, motor co-ordination, and learning are integrally related, and the principles that are applicable to one area may be true of another. For example: syntax is the basis for the organization of language. The study of the development of syntactic structures may have implications for the organization of perception and vice versa. Werner & Kaplan (1963, pp. 8-9) consider this notion to be a combination of the organismic-holistic orientation and the developmental orientation.

> ... with development -- both in phylogenesis and in human ontogenesis -- local activities become more and more interrelated and integrated, that is come more and more under the control of and

> the determination by the focal goal oriented activities of the organism. Concurrently, the nature of the organism-environment transactions undergoes marked change.

Experiments which seek to isolate the characteristics of children with learning disabilities often generate contradictory results since many do not use sufficient controls, do not take the organismic interaction into account, and are not predicated on an adequate knowledge of child development. Thus, knowledge of the way children use syntactic structure to organize the learning of verbal material may lead to some hypotheses about how children organize other activities through the media of language or perception. This knowledge may have indirect implications for children with learning difficulties.

The field of psycholinguistics has mushroomed during the past decade with the result that there is much data related to the way the preschool child acquires his first language. Only recently has attention been devoted to the language development of the elementary school child. According to Olson (1970) "language as a medium provides the occasion for obtaining not only more information, but different types of information from one's perceptual world than would be necessary if the medium did not exist." However, there is very little knowledge about how children use language to facilitate learning. This knowledge is important to the educator, since much of school teaching and learning occurs through the medium of language.

The English language has various organizing properties embedded in its phonological, morphological, syntactic, and semantic structures. For example: Word order, intonation contour, and bound morphemes and function words are the organizational elements inherent in syntax. These are the apparent patterns of organization based on surface data and combinatorial logic. Additional less obvious organizational properties may also exist. The following study is concerned with the processes involved in children's use of syntactic cues to organize, and thus facilitate the learning and retention of verbal material. The results have implications for reading and language instruction.

CHAPTER II

REVIEW OF THE LITERATURE

How does man organize his world? What are the genetic origins of the propensity toward structure and organization? The above questions are examined in the first part of chapter II in order to give the reader an orientation to the general point of view of the author. This brief overview includes comparative, neuropsychological, and physiological explanations of the way man organizes his behavior, a discussion of the process of perceptual learning, a description of the interaction between thought and language, an illustration of the ontogenetic factors involved in the organization of behavior through the concept of serial order, and the role of speech in the regulation of behavior. It is followed by a description of the development of syntactic structure in pre-school and elementary school children, and a discussion of some of the theoretical issues. Although the focus of research has previously been on the pre-school child, in recent years some attention has been devoted to the language development of children between the ages of 5 and 12. These studies are summarized and some general conclusions are tentatively advanced. The final section of chapter II consists of a review of a group of experiments which employed a similar methodology to the study reported on in the thesis, and the advancement of a

tentative hypothesis.

ORGANIZATION OF STIMULI AND RESPONSES

Comparative, neuropsychological and physiological explanations

There is much psychological data to show that not only is man himself a highly organized creature, but that he organizes stimuli and responses in a very efficient manner. Comparative psychologists have shown that in animals that are lower on the phylogenetic scale, organization of stimuli occurs on the level of sensory filtering in peripheral organs. In higher organisms, however, the organization occurs in the cortex where cognitive and motivational factors can influence this activity. In the frog, for example, selection of information occurs at the level of the retina, whereas in the cat and human visual system, the most important organization occurs in the visual cortex (Hubel, 1963). There are, of course, collaterals--branches of nerves--from the reticular formation and limbic system to the cortex, which produce speculation that emotional and motivational factors influence the cognitive organization.

Luria (1970), a Russian neuropsychologist, conceptualized the human brain as being divided into three functionally different blocks. The first consists of the midbrain area and includes the reticular formation and limbic system. This area is involved in the maintenance of arousal, and motivation and emotion. The second block, which includes

the posterior section of the cortex, is subdivided into three functionally differentiated zones. In this area are located the visual, auditory, and somesthetic cortex. The function of the primary zone is to receive sensory signals. The secondary zone codes, organizes, and interprets these signals, while the tertiary zone is concerned with the integration of the coded communication from several sources. The third block, the frontal region, is involved in the overall grand planning and organization of an activity. The three blocks are functionally differentiated, but they interact with each other in order to produce the organized, planned behavior that is characteristic of human beings.

Werner & Kaplan (1963, p. 9) stated the effects of the neuropsychological development through phylogenesis described above:

> At phylogenetically earlier levels, the milieu impinges upon the organism and to a great extent effects its behavior in the form of physicochemical stimuli--as energies which evoke direct and relatively stereotyped reactions from the organs or parts affected. At higher levels, the environment defined earlier by physicochemical stimulation and reactivity is converted through both species-specific instrumentalities and individually learned patterns of response into a field or fields of stimulus-signs or signals, instigating and guiding sensory-motor goal-directed actions on things--actions serving predominantly biological ends of maintaining the existence of individual, group, and species. Finally--and most characteristically and elaborately at the human level--the environment is not only reacted to and acted upon but is cognized, or "known," in the form of perceptualized and conceptualized objects.

Various theorists have speculated as to how people cope with ordered stimuli. The associative chain theory is

an attempt to account for temporal integration using S-R principles. Its most eminent advocate is Hull (1930). It assumes that the individual responses in any serially ordered behavior are under the control of proprioceptive feedback from the immediately preceding responses. In terms of language, Osgood (1953) postulates the presence of fractional anticipatory goal responses, and Berlyne (1965) suggests chains of symbolic covert responses made up of situational and transformational representations. Lashley (1951), a physiological psychologist, raises two objections. Firstly, some serial tasks (for example, playing a piano) are carried out so rapidly that there would not be time for the nervous system to conduct an impulse from the receptor to the brain (or spinal cord) and back to the muscle. Secondly, in any well-organized temporal behavior, the same response elements may occur in a variety of different sequences. He postulates an on-going semi-autonomous central neural process which governs sequencing behavior. The schema of order is a mechanism which determines the serial activation of motor units, and is relatively independent both of the motor units and the thought structure. On a physiological level, Lashley hypothesized the existence of elaborate reverberatory circuits to account for serial order activity.

The Process of Perceptual Learning

Perceptual learning may be defined as "a lasting change in the perception of an object or event resulting

from earlier perceptions of the same things or related things" (Hebb, 1966, p. 112).

Olson (1970 p. 187) extended this formulation when he stated that "it is performatory attempts in various media which provide the occasion for apprehending further information from the perceptual world". This concept accounts, to a certain extent, for the way a child learns to organize his environment during the course of development. For example: tachistoscopic perception experiments demonstrate how perceptual learning influences the way an individual organizes the material he sees when he is reading. A scanning process (similar to that described by Lashley) that translates spatial information into temporal sequences appears to be in operation. This is substantiated by dichotic listening experiments (Hebb, 1966, pp. 259-260). The sequential processes involved in reading are learned, as shown by the studies comparing subjects who speak English with those who speak Yiddish and Japanese, the positive correlations with educational grade level, and the differing results between the perception of alphabetic and nonalphabetic material (Bryden, 1967).

Thought and Language in Development

The material quoted above indicates that the human brain can and does organize input and actions, and that perceptual learning plays a role in this activity. The way a child perceives and organizes his environment certainly changes during the course of his development. Vygotsky,

(1962) and Piaget (1968) have described stages of development which include this factor.

Vygotsky (1962) investigated the relationship between thought and language. He claimed that in their ontogenetic development the two have different roots, that there is a pre-intellectual stage in the language development of the child and a pre-linguistic stage in his thought development.

> Up to a certain point in time, the two follow different lines, independently of each other. At a certain point these lines meet, whereupon thought becomes verbal and speech rational (Vygotsky, 1962, p. 44).

According to Vygotsky, language is initially prompted by social exigencies. The egocentric speech of the preschool child is an exteriorization of thought processes and a precursor to inner speech. This formulation may be contrasted with Piaget (1930) who considered the thought of the very young child to be nonverbal and autistic; the child then proceeds through a stage of egocentric thought and speech to a stage of socialized speech and logical thinking.

Both Vygotsky (1962) and Piaget (1968) delineated three major stages of development. The former tied his stages to language development whereas the latter did not. According to Vygotsky (1962, p. 60) the syncretic phase of the young child is characterized by "the merging of the most diverse elements into one unarticulated image on the strength of some chance impression". To Piaget, sensorimotor intelligence is "entirely practical intelligence

based on the manipulation of objects; in place of words and concepts it uses percepts and movements organized into action schemata" (Piaget, 1968, p. 11). The pre-operational stage involves intuitive intelligence with modes of reasoning closely tied to perception. Vygotsky's phase of complexes and Piaget's stage of concrete operations are very similar. Here, individual objects are united in a child's mind not only by his subjective impressions but also by the concrete and factual bonds which exist between these objects. For both Piaget and Vygotsky, adolescence is characterized by the ability to use abstract thought. Piaget names this stage formal operations and Vygotsky calls it the phase of true concepts.

Serial Order in Development

The following studies show how children's concept of serial order (the ability to organize items in a temporal sequence) develop between the ages of 3 and 6. Piaget & Inhelder (1956, p. 82-83) asked children to reproduce the order of coloured beads on a string. Between ages 3 and 4 they were capable of choosing the correct colours to correspond to the stimulus pattern, but paid no attention to the sequence. Children who had attained the next substage could place the items in pairs by the principle of proximity but could not co-ordinate the pairs with one another. Between the ages of 4 and 6 the children could string the beads in correct order when the situation permitted them to employ visual correspondences, i.e. when there was an

identical perceptual configuration between the model and its copy. Slightly more advanced children could transpose a circular order into a linear order, and achieve a reverse order by a trial and error method. Only at the age of 6 or 7 did Piaget consider the child's concept of serial order to be operational. At this age, most of the children could immediately reproduce a reversed order and transpose a figure-eight into a linear order.

In a similar experiment, Gottschalk, Bryden, & Rabinovitch (1964) required children to name the pictures on a spatial display, and recorded the order that children between the ages of 3 and 6 employed. The results showed a definite developmental trend toward imposing a temporal order on the spatial array. Some of the older children employed English reading order (left to right, top to bottom). Gottschalk (1965) discovered that 6 year old children find a random spatio-temporal presentation of pictures relatively more difficult to recall on a recognition test than do younger children when the superiority of the 6 year olds on the other test conditions is taken into account. These experiments indicate that the concept of order develops with age, and that it becomes a more important factor in the organization of perception as the child grows older. They support Kephart's (1964) contention that most children begin school with the ability to both follow a temporal sequence and to impose order on a spatial stimulus.

The Role of Speech in the Regulation of Behavior

Luria (1961) studied the role of speech in the regulation of behavior. He delineated four stages. 1. Before age 3, speech does not ordinarily serve as a regulator of a child's actions. 2. From age 3 to 4, speech can regulate motor action, but this is due to the initiating and impellent, not the significative aspects of speech. 3. At approximately age 4 and 5 the significative connections of speech regulate motor actions. 4. In children older than 5 years of age, internal speech and thought controls motor action.

By the time a child enters school, he organizes stimuli that are not themselves ordered, can cope with structured events, and uses internal speech to control his actions. The question that ought to be considered is what qualitative changes occur beyond this point. This thesis will only explore one small aspect of this larger issue -- how do children between the ages of 5 and 10 use the syntactic cues of the English language to organize and learn verbal material.

THE EARLY DEVELOPMENT OF SYNTACTIC STRUCTURE

The publication of Syntactic Structures by Noam Chomsky (1957) has stimulated research into the way a child acquires his first language and the nature of children's syntax. Several longitudinal studies (Brown & Fraser, 1964; Brown & Bellugi, 1964; Brown, Fraser, & Bellugi, 1964; Miller & Ervin, 1964; Braine, 1963) have generated much

data, and many theories (McNeill, 1966; McNeill, 1970) have been emerging to explain the data. A brief description of the development of syntax in English speaking children follows. (The description only applies to surface data, since the grammatical model underlying these data is purely speculative). Many individual differences occur in the sequence described below, and the stages should not be considered as fixed and inflexible.

In relation to cognitive development, syntactic development is a very rapid process.

> Grammatical speech does not begin before one and one-half years of age; yet, as far as we can tell, the basic process is completed by three and one-half years. Thus a basis for the rich and intricate competence of adult grammar must emerge in the short span of twenty-four months (McNeill, 1966, p. 15).

The child's speech before the age of 18 months is characterized by the one vocable utterances which Werner & Kaplan (1963) designated as monoremes, and McNeill (1970) called holophrastic speech. These vocables have conative, expressive, and referential functions (McNeill, 1970, pp. 20-25) and manifest a double fusion--attitude and reference, vocalization and gesture (Werner & Kaplan 1963, pp. 134-135). Intonation is intimately involved in the various functions of holophrastic speech. McNeill (1970, p. 20) considered these utterances to be one word sentences since he claimed that the single word utterances express complex ideas. Werner & Kaplan (1963, p. 138) took the opposite position when they stated that "a name becomes a word only

insofar as it fulfills a grammatical and syntactic function in an utterance, a function beyond its role as designator of something. Correspondingly, sentences are formed only when speech units become articulated into words".

Between 18 and 24 months, most children begin to form two vocable utterances (such as "bye-bye plane"). Their speech seems telegraphic since articles, prepositions, auxiliary verbs, and inflections on verbs and nouns are usually omitted (these aspects are unstressed in adult speech), and ungrammatical combinations are sometimes used (Brown & Fraser, 1964). Upon analysis, it was found that the sentences consist of two classes of words which Braine (1963) calls "pivot" and "open" class words and which Werner & Kaplan (1963, p. 145) describe as deictic-vocative and depictive. The child's vocabulary contains fewer pivot class words than open class words, and the individual pivot words are used more frequently than each open class word. New members are added to the pivot class relatively slowly. An utterance may consist of two open class words, or a pivot class word and open class word, but never two pivot class words. Thus, pivot words resemble function words rather than content words in adult speech.

Werner & Kaplan (1963, pp. 147-151) delineated three phases of the two vocable utterance stage. Duoremes are two vocable utterances in which the deictive and the depictive vocable are directed toward the same relatively undifferentiated referent. At an intermediate stage, the referents are somewhat differentiated but are still

overlapping. Finally, the two vocables refer to two distinct referents. With the increasing differentiation between referents, a means must be employed to relate or integrate the vocables so that they constitute a unified expression. Intonation progressively undergoes a "shift from a designatory to a syntagmatic function", and is the most important means for achieving the integration of vocables.

> There seems to be a characteristic progression in accent from "level stress" that is a pattern of the same intonation in both vocables, to "uneven stress" expressed through differences in intensity, pitch, and/or duration.

Thus, intonation is the first manifestation of syntactic structure in children's speech.

Only a few months after the appearance of two vocable utterances the child usually expands his span to three or four word sentences, and includes articles and demonstrative pronouns. The child imposes his own characteristic but inflexible order on the words in his sentences. While the child's first utterances include only one pivot and one open class word, or two open class words, these later sentences are hierarchical, and may include noun or verb phrases (for example, "that my coat" and "want my coat"). Thus, in English, the syntactic cue of word order emerges at this stage.

Brown & Bellugi (1964) considered three processes to be crucial to the child's acquisition of syntax. 1. Children's early speech is telegraphic. In reproducing a model English sentence the child preserves the original

order, but omits most of the function words. The authors called this process "imitation by reduction".

> Forms likely to be retained are nouns and verbs and, less often, adjectives, and these are the three large and "open" parts-of-speech in English. The number of forms in any one of these parts-of-speech is extremely large and always growing. Words belonging to these classes are sometimes called "contentives" because they have semantic content. Forms likely to be omitted are inflections, auxiliary verbs, articles, prepositions, and conjunctions. These forms belong to syntactic classes that are small and closed. Any one class has few members and new members are not readily added. The omitted forms are the ones that linguists sometimes call "functors", their grammatical functions being more obvious than their semantic content (Brown & Bellugi, 1964, p. 138).

2. "Imitation with expansion" refers to the fact that mothers (particularly middle class mothers) tend to expand the utterances of their children. In doing so, they preserve the order of the children's words, and they add function words. Slobin (1965) examined the exchanges between mother and child when the mother expanded the child's utterance and the child imitated the expansion. Slobin found that under these conditions the child expanded his own previous utterance about half the time.

3. Brown & Bellugi (1964) called the third process "induction of the latent structure". The child grasps the underlying basis of the language and is able to use transformations to generate new sentences.

> In summary, one major aspect of the development of general structure in child speech is a progressive differentiation in the usage of words and therefore a progressive differentiation of syntactic classes. At the same time, however, there is an integrative process at work (Brown & Bellugi, 1964, p. 149).

Bound morphemes and function words are the third type of syntactic cue which is evident in English. There has been some research done on the emergence of certain transformations in children's speech including the interrogative, negations, and inflectional endings (Bellugi, 1964; Lenneberg, 1967; McNeill, 1970). By the time a child enters school he has usually mastered the transformations referred to above and can generally speak a language which is considered grammatical by adult standards.

THE DEVELOPMENT OF LANGUAGE IN THE ELEMENTARY SCHOOL CHILD

Although most children speak grammatical English by the time they enter school, the nature of the language they speak, their awareness and comprehension of the subtleties of the language, their use of abstract and more complex forms, and the way they make use of language and the various elements in a language may nonetheless differ from the adult usage. Since most school teaching and learning is accomplished through language, information concerning these differences is relevant for educators.

Although the focus of the research in language development has been with pre-school children, a few studies have been done with elementary school students. Several types of methodology have been used to study the various areas of language development. Some studies involve word association techniques, others are concerned with reading, some are descriptive studies of the child's acquisition of

complex transformations and concepts of linguistic complexity, and some require the children to use artificial or nonsense words in novel ways.

Word Association Studies

Brown & Berko (1960) and Entwisle (1966) used a word association technique to study language development in elementary school children. Both groups of investigators found that adults have a greater tendency to associate the stimulus word with another word belonging to the same part of speech (homogemeous response) than children. The tendency to make homogeneous responses decreases with decreasing age and is particularly evident when the stimulus words are count nouns or adjectives. The studies indicate that children often expand the stimulus word into a phrase (eg. "begin-work") whereas adults usually respond with synonyms or antonyms (eg. "begin-start").

Reading Studies

Jackson (1970) was interested in the role of memory in reading comprehension. He presented three types of free recall lists of 25 English words to children in grade 6. One list was semantically organized (SOL) -- groups of words were related to each other semantically. A second list consisted of groups of linguistically related words (LOL) -- those belonging to the same parts of speech. A third list was random (ROL) -- it consisted of unrelated words. The words were selected from three stories which

the children were required to read. Comprehension of the story was tested by the Cloze Test. In this test, every fifth word was deleted, and the child was supposed to fill in the missing words.

Jackson found that the children organized the words on the SOL, i.e.,tended to group them in ordered clusters related to their meaning when they responded. Some small amount of subjective organization was apparent in the ROL, but none was detected in the LOL. Furthermore, the degree of organization the children imposed on the lists was positively correlated with the number of words they retained and their comprehension of the stories as measured by the Cloze Tests. The children did not organize the words in the LOL on the basis of part-of-speech -- they did not use the linguistic cues to facilitate their learning. Jackson concluded:

> This may mean that the semantic cue of conceptual category could facilitate the processing of language while the linguistic cue of part-of-speech may not facilitate the role of memory in language processing.

It may be argued, however, that children might make quite different use of syntactic cues in the context of the sentence, as opposed to a free recall list.

Transformations

Slobin (1966) and Hayhurst (1967) have traced the development of the passive and negative transformations in elementary school children and in adults. Slobin calculated the reaction times and error scores of students in kinder-

garten, grades 2, 4, 6, and University to a sentence describing a picture. In reversible sentences (those where the object could serve as the subject) children perceived kernel sentences in the active voice most quickly and accurately, passive sentences somewhat less rapidly, negatives again more slowly, and passive negatives most slowly. When sentences were non-reversible, there was no difference between the rate of perception of the active and passive sentences. The number of errors of all the subjects, including the kindergarten children were small. Thus Slobin concluded that comprehension of passives and negatives is normally established prior to age 5.

Hayhurst (1967) required 5, 6, and 9 year old children to construct sentences which were identical in form to model sentences, and accurate descriptions of pictures.

> Sentences were passive and passive negative, with or without expressed actors, subject or object in the former being either reversible or nonreversible. Errors in construction declined with age and were fewest in sentences without expressed actors. The most common error was to turn the passive sentence into its kernel form. In passive negative sentences, kernels could be of the correct sentence or of a similar one which was not true of the picture. Production of the former increased with age, while the latter decreased. Nonreversibility helped older subjects, but not younger ones to produce true kernels. The errors of older children approached more closely the correct sentence form than did those of younger children.

Thus, although comprehension of the passive and negative transformations is normally established prior to age 5, the ability to construct these forms precisely is acquired between the ages of 5 and 9.

Linguistic Complexity

Carol Chomsky (1969) and Kessel (1970) studied the acquisition of syntax in children between the ages of 5 and 12. The former investigated four conditions of linguistic complexity.

> 1. The true grammatical relations which hold among the words in a sentence are not expressed directly in its surface structure (Carol Chomsky, 1969, p. 7).

This principle is illustrated by the contrast between the following sentences:

(1) John is eager to please.
(2) John is easy to please.

Whereas the name "John" is clearly the subject of the former sentence, it is only superficially the subject of the latter sentence. The latter may be paraphrased by the sentence "To please John is easy". The deep subject is actually "to please John". Furthermore, in sentence (1) "John" is the subject of the complement verb "to please", whereas in sentence (2), "John" is its object. In the former case John is performing the action, whereas in the latter case John is being acted upon. Both Carol Chomsky (1969) and Kessel (1970) found that the ability to correctly interpret the "eager" sentence is fully developed by the age of 6, but that some 6, 7, and 8 year-old children have difficulty with the "easy" construction, assigning in its place the "eager" interpretation. Since many of the children correctly comprehended both types of sentences, the "eager-easy" distinction "can hardly be determined a late acquisition in the course of language development"

(Kessel, 1970, pp. 38-39).

> 2. The syntactic structure associated with a particular word is at variance with a general pattern in the language (Carol Chomsky, 1969, p. 9).

The general pattern in English which was studied by Chomsky and Kessel is the Minimal Distance Principle (MDP)--"the implicit subject of the complement verb is the noun phrase most closely preceding it" (Carol Chomsky, 1968, p. 10). Most verbs of command or request conform to the MDP, whereas the verb "to promise" violates the principles. For example:

(3) John told Bill to leave.
(4) John promised Bill to leave.

In the former case it is Bill who leaves, whereas in the latter case, John is required to leave. Children under age 6 tend to overgeneralize the MDP by applying it to the exception "Promise". Between the ages of 5.6 and 9 the children gradually acquired the ability to respond to the exception correctly, with the 9 year-old children able to do the task without any errors.

> 3. A conflict exists between two of the potential syntactic structures associated with a particular verb (Carol Chomsky, 1969, p. 15).

The following sentences illustrate the above condition:

(5) John asked Bill to leave.
(6) John asked Bill what to do.

Carol Chomsky (1969) found that there are many individual differences in the ability to comprehend the distinction between the two uses of "ask" in children between the ages of 6 and 9. Five year-old children were consistently unable to perform the task, whereas most 9 year-olds

responded correctly. On the other hand, Kessel (1970, p. 55) found that the error rate was low among 7 year-olds and that almost every 8 year-old distinguished the subject assignment for the two usages of "ask". Kessel attributed the discrepancy between his results and those of Carol Chomsky to small differences in the tasks which the children were required to perform.

> 4. Restrictions on a grammatical operation apply under certain limited conditions only (Carol Chomsky, 1969, pp. 18).

The question of the stage in development in which the English child becomes aware that a nonidentity restriction on pronomial reference exists in his language was investigated by Carol Chomsky. The following sentences illustrate the problem:

(7) John knew that he was going to win the race.
(8) He knew that John was going to win the race.

In sentence (7) the pronoun "he" may or may not refer to "John" ie. the nonidentity restriction does not hold. In sentence (8), however, "he" cannot refer to "John" -- the nonidentity restriction is upheld. A consistent developmental shift was observed by Carol Chomsky. She found that children younger than age 5.6 did not know the construction whereas children older than 5.6 consistently responded correctly. This pattern was clear and uniform in all the children observed.

Kessel (1970) examined children's detection of three types of sentence ambiguities:

> 1. A sentence is lexically ambiguous if a word or sequence of words has two distinct meanings and no differences at the other grammatical levels.
>
> 2. Ambiguity at the surface structure level involves the possibility of two distinct groupings of adjacent words.
>
> 3. Ambiguities at the underlying structure level involve only a change in the logical relations between words.

The 6 and 7 year-old children easily detected the lexical ambiguities, but only at the age of 12 were the children able to consistently detect the surface structure and underlying structure ambiguities.

Studies Using Artificial Words

Braine (1963) developed a theory of "contextual generalization" based on experiments where elementary school children learn miniature artificial languages. On the basis of the experiments, he proposed the following theory.

> a) What is learned are the locations of units, and associations between pairs of morphemes. b) The location learned is the location of a unit within the next larger containing unit of a hierarchy of units. There are hierarchies at two levels: within the sentences the units are primary phrases, and sequences of primary phrases; within primary phrases the ultimate units are morphemes. c) The learning of locations is a case of perceptual learning -- a process of becoming familiar with the sounds of units in the temporal positions in which they recur.

Werner & Kaplan (1963) in their theoretical work on symbol formation formulated three developmental principles. The orthogenetic principle refers to the "tendency to move from a state of relative globality and undifferentiatedness towards states of increasing differentiation and hierarchic integration". The genetic principle of

spirality involves "a partial return to more primitive modes of functioning before progressing towards fullfledged higher operations". The principle of shift of function has been briefly alluded to above. There are genetic changes, both phylogenetic and ontogenetic, "in the ends to which organisms are directed and in the relationship of means to the realization of ends". Whereas young children (and lower organisms) are directed toward biological ends, when the directedness towards knowing begins to emerge, "the world undergoes a most significant transformation from things-of-action to objects-of-contemplation" (Werner & Kaplan, 1963, pp. 6-18).

According to Werner & Kaplan, syntax should not be divorced from semantics. Words and sentences are defined linguistically.

> A name becomes a word only insofar as it fulfills a grammatical and syntactic function in an utterance, a function beyond its role as designator of something. Correspondingly, sentences are formed only when speech units become articulated into words (Werner & Kaplan, 1963, p. 135).

For this reason, the Word-Context-Test (described below) of necessity involves defining words in a sentence.

The concept of distancing is crucial to Werner & Kaplan's theory of symbol formation. There are four components of symbolic activity--an addressor, an addressee, a referent (or object of reference), and the symbolic vehicle employed in referential representation. The primordial sharing situation is the earliest form of interaction. It may be described as "one in which the

distancing between the components has hardly begun to form; it is a pre-symbolic situation in which there is little differentiation in the child's experience between himself, the other (typically the mother), and the referential object". During the course of development, each of the four components undergo fundamental change --"the addressor matures, the addressee changes from parents to peers to generalized others, the referents become increasingly complex and abstract, and the symbolic vehicles are of an increasingly conventional and communal nature". The relationship between the four components also changes. "Initially, they are more or less fused with each other; then they become progressively differentiated from each other and at the same time linked or integrated with each other in various ways". Thus, increasing distance develops between person and object, person and symbolic vehicle, symbolic vehicle and referential object, and addressor and addressee. The transformations in these relationships continue with the developmental objective being an autonomy of the linguistic medium (Werner & Kaplan, 1963, pp. 40-42).

The processes involved in the development of autonomy of the linguistic medium were examined by Werner & Kaplan (1950) by means of the Word-Context-Test. A word common to six English sentences was replaced by a nonsense or artificial word. Children ranging in age from 8.6 to 13.6 years were required to discover the meaning of the artificial word from the context of each sentence. Responses were given to each sentence separately, then the

child was required to show how a meaning which applies to one sentence applies to the previous ones. Two types of errors were analyzed. "Sentence contextual errors" are a "lack in the differentiation between the meaning of the word and the given verbal context". A second form of error involves setting the word meaning apart from the rest of the sentence, but giving the word a "wide situational connotation rather than a circumscribed stable one". This latter type of error decreased gradually in frequency with the increasing age of the child. Sentence contextual errors, however, were frequent in 8, 9, and 10 year old children, but dropped off sharply at age 10.6, suggesting "a rather fundamental shift in language attitude".

Werner & Kaplan (1964) interpreted the above data thus: In the younger children there was a "relative lack of differentiation between words and sentence-contexts". At a slightly higher level, the word was only partly fused with the sentence context. Since the child, in this instance, was using speech in a "syncretic, relatively undifferentiated manner, formally analogous to his behavior at earlier levels of linguistic activity", this is a manifestation of the genetic principle of spirality. At a third stage- "word-embeddedness", the child could not subsume context-specific meanings under a more general concept. At the next stage, that of "pluralization", the child could discover the more general concept, but did not realize that this concept can replace each of the other

more specific concepts. At the stage of "transposition" the child expanded the meaning of one context-specific solution -- equating all the other specific meanings with that one solution. Word-sentence fusion and partial overlapping occurred frequently between the ages of 8.6 and 10.6, and then sharply decreased. Word-embeddedness, pluralization, and transposition were not common at any age level, but while aggregation decreased at age 10.6, pluralization and transposition were manifested until age 12.6. By age 12.6 the children attained true lexical concepts, and did not distort the sentences.

Werner & Kaplan outlined what they considered to be the characteristics of the fully developed lexical concept: 1. "It is symbolized as a word, as a vocable having syntactic-grammatical as well as referential function." 2. "It is isolable from specific linguistic contexts", and 3. "it is capable via the word-form of being placed in a variety of linguistic contexts (sentences) as a unit in the building up of complex references" (Werner & Kaplan, 1963, pp. 197 - 200).

The review of the literature on the development of syntactic structures in the elementary school child leads to three general conclusions:

1. Elementary school children learn to construct the more complex transformations involved in passive, and passive-negative sentences (Slobin, 1966; Hayhurst, 1967). They also acquire the ability to cope with linguistic

complexity including ambiguity of surface and underlying structure, and exceptions to the general pattern of the language (Carol Chomsky, 1969; Kessel, 1970).

2. Syntax and semantics are not two separate entities. While it is sometimes convenient to discuss the two constructs separately when referring to pre-school children, the greater part of the language development of elementary school children occurs where syntax and semantics intersect (Brown & Berko, 1960; Entwisle, 1966; Jackson, 1970; Chomsky, 1969; Kessel, 1970; Werner & Kaplan, 1963).

3. The later developments toward autonomy of the linguistic medium include an ability to define and to abstract, which is finally achieved at about age 12. The linguistic structures of words and sentences become more established as definite forms which cannot be distorted. In this sense, the child does not only use words and sentences, but becomes more aware of his use of language.

THEORETICAL ISSUES

In this section, three aspects of the psychological implications of Noam Chomsky's theory of generative grammar are discussed. The first is the underlying basis of the theory in rationalist thought. The second is the distinctions between linguistic competence and performance, and the third is the nature of the language acquisition device (LAD) and the notion of linguistic universals. The author modifies McNeill's conceptualization of LAD, and the

implications of this modification for the other aspects of Chomsky's theory are discussed.

1. Noam Chomsky (1966, p. ix) considered the fundamental question of the philosophy and psychology of language to be "how experience and maturational processes interrelate within the framework of innate limiting conditions to yield the linguistic competence exhibited by a normal speaker of a language". He stated that "the mental capacities that underly the achievement of normal linguistic competence...may be as individual and species-specific as that of a bird to learn a particular class of songs, of a beaver to build dams, or of a bee to integrate its own actions into the intricate social activities of the hive". Chomsky assumed that

> ...language acquisition is a matter of growth and maturation of relatively fixed capacities, under appropriate external conditions. The form of the language that is acquired is largely determined by internal factors; it is because of the fundamental correspondence ot all human languages, because of the fact that "der Mensch Uberall eins mit dem Menschem ist" that a child can learn any language. The functioning of the language capacity is, furthermore, optimal at a certain "critical period" of intellectual development (Noam Chomsky, 1966, pp. 64-65).

2. Noam Chomsky (1965, p.4) distinguished between linguistic performance, "the actual use of language in concrete situations", and linguistic competence, "the speaker-hearer's knowledge of his language". McNeill (1970, p. 145) further defined these two terms:

> There are, first of all, actual acts of speaking and hearing, taking place in time, subject to various distractions, limited by memory and by the

> general weakness of human flesh. These were called actes de parole by de Saussure and performance by Chomsky (1957).
>
> The second aspect of language is the knowledge of syntax, meaning, and sound that makes performance possible. De Saussure called such knowledge langue and Chomsky has called it competence. (McNeill, 1970,p.145)

Chomsky (1965, p. 4) returned to the Humboldtian conception of "underlying competence as a system of generative processes":

> A grammar of a language purports to be a description of the ideal speaker-hearer's competence. If the grammar is, furthermore, perfectly explicit--in other words, if it does not rely on the intelligence of the understanding reader but rather provides an explicit analysis of his contribution--we may (somewhat redundantly) call it a generative grammar.
>
> ... by a generative grammar I mean simply a system of rules that in some explicit and well-defined way assigns structural descriptions to sentences. Obviously, every speaker of a language has mastered and internalized a generative grammar that expresses his knowledge of his language. This is not to say that he is aware of the rules of the grammar or even that he can become aware of them, or that his statements about his intuitive knowledge of the language are necessarily accurate (Noam Chomsky 1965, p. 8).

3. Noam Chomsky (1957, 1965) and McNeill (1970) postulated the existence of a theoretical construct which they called a language acquisition device, or LAD. "Our theory of language acquisition will be that the theory of grammar and its universal constraints describe the internal structure of LAD and, thus of children". LAD interacts with the large corpus of grammatical utterances the child hears (primary linguistic data).

> Given such a corpus, LAD is so constructed that it can develop a theory of the regularities that underly the speech to which it has been exposed. The theory is LAD's grammatical competence, its knowledge of the language. LAD now becomes able to go far beyond the corpus with which it began. It can distinguish the infinitely many grammatical sentences in its language from the infinitely many nongrammatical alternatives (McNeill, 1970, p. 70).

According to McNeill, LAD may contain one or both of two major components. The first is a body of linguistic information which is universal--present in all languages. Many of these "universals" are discussed by transformational linguists.

> Some are phonological. Every language, for example, employs consonants and vowels, syllabic structure, and a handful of distinctive features (Jakobsen & Halle, 1956; Halle, 1964a). In the case of syntax, every language utilizes the same basic grammatical categories, arranged in the same way--sentences, noun phrases, verb phrases, etc. Every language utilizes the same grammatical relations among these categories--subject and predicate, verb and object, etc. All of these are characteristics of the abstract underlying structure of sentences (McNeill, 1970, p. 71).

The second major component is "a set of procedures for operating on a corpus--for example, conducting a distributional analysis, or using inference rules, for finding transformations of different kinds". Although McNeill has stated that this second component has not been examined by linguists, the author believes that children possess an ability to organize primary linguistic data which they hear, and are able to assimilate the organization inherent in the language, perhaps by the process of perceptual learning (as defined above).

Although there is insufficient evidence to prove

that children possess only the capacity to organize primary linguistic data, Noam Chomsky's and McNeill's assumption of universal linguistic information also suffers through lack of support.

What are the implications of the point of view taken above for the major premises or Noam Chomsky's theory of transformational grammar? They appear to be three-fold:

1. Chomsky's strong rationalist statements must be tempered, and a more moderate point of view advanced. Transformational grammar is a useful model or language which purports to describe the grammar of an ideal speaker-hearer. As such it serves a valuable purpose. Extrapolations from the model to psychological theory may be tenuous, and they certainly should not be regarded as more than hypotheses. Man is not an ideal speaker-hearer. Thus, a linguistic model based on this assumption cannot be applied to psychological theory without substantial modifications.

The effect of varying the primary linguistic data is not examined by transformational grammarians, although Bernstein (1967) and Deutsch (1967) stated that language development varies according to social class. McNeill (1970) relegated a small role to experience.

> Children form relationships with ease, but require time to learn the restrictions on relationships. The contribution of experience will therefore be where general rules apply least (McNeill, 1970, p. 104).

The author ascribes a larger role to experience, particularly early experience, in learning a new language. Innate ideas are not stored in the brain. Therefore, the child is not

born with the knowledge of linguistic transformations. He learns these transformations through interaction with vast amounts of primary linguistic data. Perceptual learning (as defined above) may be the process involved. This learning is later used by the child in his capacity of speaker-hearer.

If innate ideas are not stored in the brain, what is the role of the central nervous system? According to Luria (1970) the Wernicke and Brocha areas (in the posterior part of the left cerebral hemisphere), which are responsible for speech, are located in the second block of the brain. The secondary zone of the second block codes and organizes the sound waves which represent linguistic stimuli, and the tertiary zone is responsible for a "synthesis of a collection of informational inputs from different sources into a coherent whole". Lesions in the tertiary zone often "render a person incapable of performing complex operations with numbers or of coping with a complexity in grammar, logic, or language structure". Although language may be a species-specific activity, the evidence cited above concerning the increasing plasticity of behavior during phylogenesis indicates that human language is not nearly as stereotyped as the instinctive behavior of lower organisms.

2. The author does not consider it necessary to postulate a language acquisition device. Although the notion of LAD may be useful from the point of view of formal linguistics, developmental psychologists have not yet

adequately justified its creation for their purposes. Theoretcial constructs of this nature tend to become reified, and interfere with the observation of real human beings.

3. Noam Chomsky's formulation of the distinction between competence and performance should be modified in the light of the above hypothesis. In the present framework, it may be easier to distinguish three levels. The first level, psychological competence, is defined as the capacity to discover the organization inherent in primary linguistic data, and to apply this knowledge to the ordering of new information. A second level, linguistic competence, is the person's actual knowledge of linguistic information, and superficially conforms to Chomsky's notion of competence. The third level, performance, is consistent with Chomsky's definition of the term. Both the psychological and the linguistic competence of the speaker can only be inferred; the latter may be inferred from the study of performance, whereas the former may also be studied by means of the clinical techniques of the neuropsychologist (Luria, 1970). The careful observation of the behavior of brain-injured individuals leads to inferences about the psychological competence of normal people. This is due to the fact that no idealized speaker-hearer does exist. Language always occurs in a social situation, and is subject to the psychological limitations of the speaker-hearer.

Further discussion of the author's reinterpretation of the psychological implications of Noam Chomsky's theory of generative grammar may be found in Chapters IV and V.

The following definition of syntactic structure, originally formulated by Lashley (1951), is presented by way of conclusion:

> ...syntactic structure is a generalized pattern imposed on the specific acts as they occur, and...a consideration of the sentence and other motor sequences will show...that there are, behind the overtly expressed sequences, a multiplicity of integrative processes which can only be inferred from the final results of their activity (Noam Chomsky, 1959).

SYNTACTIC STRUCTURE AND VERBAL LEARNING

Although the majority of the research reviewed in this section is concerned with adults, the design of the studies is sufficiently similar to the thesis study to warrant report in some degree of detail.

Miller & Isard (1963) used three types of stimulus material--grammatical sentences, ungrammatical strings of words, and syntactically acceptable but semantically anomalous strings of words. The subjects shadowed (repeated aloud immediately afterwards) tape recorded stimuli. The grammatical sentences were perceived better than the anomalous sentences which were in turn perceived better than the ungrammatical strings. It was concluded that the subjects' ability to use context was derived from an intimate though tacit understanding of both the linguistic and semantic cues of language.

Epstein (1961) designed an experiment to study the role of syntactical structure in verbal learning. He defined syntax as "the generalized pattern or schema which is imposed upon the reservoir of available words and determines the sequence of these words". Six types of sentences were composed to discover the influence of three variables on the learning of the sentences. The variables are 1) the presence or absence of syntactic structure, 2) the use of meaningful (English word) versus nonmeaningful (nonsense word) lexical items, and 3) the presence or absence of bound morphemes. An example of a sentence containing syntactic structure, English lexical items, and bound morphemes is "Cruel tables sang falling circles to empty bitter pencils". Another example, this time employing nonsense syllables, is "A vapy koobs desaked the citar molently um glox nerfs".

The subjects of the experiment were university students who were required to reproduce the sentences perfectly. A trials to criterion procedure was employed. The subjects read the sentences and wrote their responses. Epstein found that adults learned the structured (grammatical) sentences more easily than sentences where word order was random. Sentences containing English lexical items were easier to learn than those containing nonsense words. The addition of bound morphemes facilitated recall, since both bound morphemes and function words served as grammatical markers which associate a form class to a nonsense stem.

Epstein (1962) replicated the above experiment but

did not include the presence or absence of bound morphemes as a variable. He had four types of sentences -- 1) syntactically structured sentences with nonsense syllables as lexical items 2) type 1 sentences with the order of the items randomly rearranged, 3) structured sentences using English lexical items in a combination which is not meaningful, and 4) type 3 Sentences with a re-arranged order of items. The outcome confirmed the original study.

Epstein (1962) performed a third study where the four types of sentences were learned by an anticipatory serial learning procedure. The subjects were college students and the trials to criterion method was employed. It was found that all four categories of sentences were learned equally rapidly. Therefore, when a sentence cannot be perceived as a unit, the addition of syntactic structure does not facilitate learning.

Forster (1966) hypothesized that Epstein's adult subjects learned syntactically structured sentences more easily than unstructured sentences because the syntax provides clues to the correct order of the words. He decided that the facilitation effect should not be apparent if subjects were not required to recall the words in order. His hypothesis was rejected -- the structured sentences were still learned significantly more rapidly than the unstructured sentences. These results may be explained by the fact that adults learn free recall material more easily when they organize and order the material according to subjective criteria

(Bregman & Wiener, 1970). Therefore, in Forster's experiment, the subjects would probably tend to use the order implicit in the structured sentences to help them organize their responses, even if they were not required to reproduce the words in order.

Epstein's (1961, 1962) and Forster's (1966) experiments lead to the conclusion that adults use the syntactic cues embodied in the English sentences to help them organize, learn, and retain verbal material. Forster concluded that in order to explain the facilitation effect of syntactic structure it is necessary to postulate a mechanism which 1) operates under conditions of ordered as well as non-ordered recall, 2) is equally effective when bound morphemes are present or absent, 3) apparently does not require the subject to perceive the entire list as an analogue of a well-formed string of English, (4) has its effect on the learning of the nonsense syllable-bound morpheme combinations and not on function words, and (5) does not exist under conditions of serial anticipation learning.

Two attempts have been made to apply Epstein's and Forster's experiements to children. In both cases the researchers were interested in discovering whether poor readers in grade four differ from good readers in the ability to use syntactic cues to facilitate the learning of verbal material. Rabinovitch & Strassberg (1968) devised two types of sentences. The first type consisted of nonsense syllable

lexical items and English function words, and contained an English syntactic structure. In the second type of sentences, the order of the items were randomly re-arranged. Bound morphemes were present in both the structured and unstructured sentences. The grammatical frames for the structured sentences were selected from a grade three reader. A typical structured sentence is "when they sivoled the veg, they hanashed salfly". The material was presented orally and the responses were taped. A trials to criterion approach was employed with a criterion of three correct reproductions. The subjects were children in grade 4 in three schools which were situated in middle socio-economic areas of Montreal. All the children were native English speaking and functioned in the average range of intellectual ability. Their reading ability was assessed by the Gates Reading Test (Gates, 1958). It was found that the good readers learned the structured sentences more rapidly than the unstructured sentences, but the poor readers learned the two types of sentences at the same rate. Rabinovitch & Strassberg concluded that poor readers were unable to recognize and use syntactic cues to learn verbal material, and that this may be related to their difficulty with reading.

Weinstein (1968) replicated the above experiment. Singer (1968) employed the identical procedure, but his subjects were grade 4 students in Verdun, Quebec, which he considered to be a culturally deprived area of Montreal.

Singer found that both good and poor readers learned the structured sentences more rapidly than the unstructured sentences.

The experiments by Rabinovitch & Strassberg (1968), and Singer (1968) may be viewed as a stab in the dark since no developmental trends had been previously established. Rabinovitch & Strassberg (1968) wrote the following:

> It would be important to study the ability of children to use markers effectively in storing verbal information, and further, to know their reliance on either function words or bound morphemes and the comparative effect each of these markers has on the retention of items in serial order.

This statement indicates that a developmental study which shows how, and at what ages children develop the ability to use the syntactic cues of word order, and bound morphemes and function words to learn verbal material might place the above experiments in proper perspective.

SPECIFIC AIMS OF THE PRESENT STUDY

The study proposed below will be undertaken for the following reasons: 1) to show how children in elementary school use the syntactic structure of a sentence to organize their learning of verbal material; 2) to find out the nature of the developmental trend, if one does exist; 3) to discover what are the differential effects of word order, and of bound morphemes and function words in the child's use of syntactic cues.

Since no such developmental data exists, the following hypothesis is put forward cautiously. Children

in kindergarten and grade 1, for the most part, do not use the syntactic cues in sentences to help them learn verbal material, whereas most children in grades 2, 3, and 4 use syntactic structure to organize their learning. The degree of use increases with age.

The following theory is tentatively advanced to support this hypothesis. Children with little or no schooling are not accustomed to learning verbal material and therefore may not be aware that the syntactic structure therein might be a means of organizing their learning. Once they reach grade 2, the children are somewhat literate, and are more likely to have experience with this sort of learning. They have learned-- perhaps through the process of perceptual learning -- that syntactic structure is a means of organizing one's learning. The cause of a shift in modes of behavior at a particular age cannot be directly ascribed to maturation or experience. Illiterate children (and those who do not receive reading instruction) may also eventually use syntactic structure to facilitate learning. Nevertheless, school instruction may precipitate or accelerate a developmental shift of this nature.

CHAPTER III

METHOD

SAMPLE

The subjects were fifty-four students from Lynnwood Public School, which is located in a middle socio-economic area of Edmonton (Kupfer, 1967). Twelve children, six boys and six girls, were selected from each of grades 1, 2, 3, and 4, and six children were chosen from kindergarten. Pupils with known hearing deficits, and those whose native language is not English, were excluded.

Two criteria were used in selecting the sample -- age and IQ. At the time of testing, the kindergarten children ranged in age from 5.0 to 5.11, the grade 1 students were 6.0 to 6.11 years old, the grade 2 children were 7.0 to 7.11 years of age, the grade 3 students 8.0 to 8.11 years, and the grade 4 students were 9.0 to 9.11 years old.

The Lorge Thorndike Intelligence Test was administered to approximately thirty children of appropriate age and language background in each grade. Level 1 was given to the children in kindergarten and grade 1, and level 2 was written by the students in grades 2 and 3. The grade 4 students had received level 3 in March 1970. The results of this administration were used in selecting the

grade 4 sample. The mean IQ of those children selected for the final sample in kindergarten was 109.66 (ranging from 103 to 118), in grade 1 was 110.08 (ranging from 103 to 115), in grade 2 was 109.5 (ranging from 100 to 119), in grade 3 was 108.16 (ranging from 100 to 119), and in grade 4 was 109.9 (ranging from 93 to 120). Thus, all the children functioned in the normal or bright normal range of intellectual ability.

PREPARATION OF SENTENCES

Nine sentences administered in oral form were the stimulus items to be learned in the study. The independent variable was the type of syntactic cue present in each sentence. The nature of the grammatical frame employed, the method of construction of nonsense syllable lexical items, and the procedure of assignment of particularly syntactic markers to each of three types of sentences are described below.

The experimental sentences are based on the following grammatical frame:

The ____s ____ed a ____ ____ly.

The frame contains six items, four of which represent lexical items, and two of which are English function words. The word "a" may only be followed by a singular noun. The bound morphemes "s" denoting a plural noun, "ed" indicating a verb in the past tense, and "ly" denoting an adverb are important grammatical features. The frame is in the active

voice, and contains no subordinate clauses. Nonsense syllable lexical items were inserted into the frame so that the final product was a combination of nonsense syllable lexical items, and English function words and bound morphemes. Thus, the above grammatical frame, which was selected from a grade 1 reader, was the foundation for the nine sentences used in the study.

The nonsense syllable lexical items were selected from those used by Rabinovitch & Strassberg (1968) who chose the stems according to a technique devised by Forster (1966). Only those syllables considered pronounceable at a kindergarten level were selected.

> With the aid of a table of bigram frequencies in English (Underwood & Schulz, 1960), separate strings of 60 letters each were prepared using a table for random numbers. Each string was cut into segments. The length of each segment was determined by English word stems which were randomly selected from the Original Thorndike Words 1 to 500 List (1944). The common words that children use comprise this list. As an example, if the first four English word stems had 6, 4, 3, and 5 letters, respectively, then the string of bigrams was segmented after the 6th, 10th, 13th, and 18th letters. This procedure generated potential nonsense syllable stems. All syllables that were actual English words were discarded, as were syllables that violated English orthographic rules (Rabinovitch & Strassberg, 1968).

The following three groups of four nonsense syllables were selected: (A) veg, hend, parf, kafal; (B) sivol, onuc, wab, gozur; (C) lurm, hanash, swad, zalf. Each group of four nonsense syllables were inserted into the grammatical frame so that the resultant sentences contained a combination of English function words and bound morphemes, and four nonsense syllable lexical items.

Three important cues are characteristic of English syntactic structure. These are intonation contour, word order, and the use of bound morphemes and function words. Since intonation was not a variable in the study, an attempt was made to consistently use a declarative intonation contour.

Three types of sentences were prepared: type 1 sentences incorporate the three aspects of correct English syntactic structure. They feature declarative intonation contour, grammatical English word order, and the proper usage of bound morphemes and function words. In type 2 sentences the order of the items were re-arranged so that the syntactic cue of proper English word order is not present. This trait of word order differentiates type 1 and type 2 sentences. (The same items were used, and declarative intonation contour was simulated in both sentence types). English function words and bound morphemes were absent in type 3 sentences. The order of nonsense syllable lexical items used in type 1 sentences was maintained, as was declarative intonation contour. Thus, in type 1 sentences all the elements essential to English syntactic structure were present; in type 2 sentences the element of correct word order was absent, and in type 3 sentences the syntactic markers represented by bound morphemes and function words were absent.

Using the selected grammatical frame and the three groups of four nonsense syllable lexical items as a base,

three sentences of each of type 1, type 2, and type 3 were constructed. The resultant nine sentences are shown in Table I.

TABLE I

SENTENCES USED AS STIMULUS ITEMS

GROUP	TYPE	SENTENCE
A	1	The vegs hended a parf kafally.
A	2	Hended parf kafally a vegs the.
A	3	Veg hend parf kafal.
B	1	The sivols onuced a wab gozurly.
B	2	Onuced wab gozurly a sivols the.
B	3	Sivol onuc wab gozur.
C	1	The lurms hanashed a swad zalfly.
C	2	Hanashed swad zalfly a lurms the.
C	3	Lurm hanash swad zalf.

PROCEDURE

Each of the 54 children were required to learn three sentences -- one maintaining all the syntactic cues of a grammatical English sentence, one in which the order of words was re-arranged so that the result conflicts with common English usage, and one sentence lacking bound morphemes and function words. Thus, each child learned one sentence from each of type 1, type 2, and type 3. Similarly, in order that he would not encounter the same group of nonsense syllable lexical items more than once, each child learned one sentence from each of groups A, B, and C. For example: subject 3 in grade 1 learned sentences A1, C3, and B2, and

subject 4 in grade 4 learned sentences B3, A2, C1.

Each child learned three sentences during the course of an individual testing session of one-half hour. The testing took place in the school medical room. Upon entering the room, and after the usual introductions, the child was informed that he was chosen to help the investigator in an experiment. After a discussion concerning the nature of experiments in general and psychological experiments in particular, he was told that he would be required to learn to recite perfectly a funny sentence in a nonsense language. He was instructed to listen to the sentence carefully, and then recite whatever he could remember. He could then listen to the sentence again, and try to recite it a second time. This procedure was repeated until the child said the sentence perfectly. The child was asked to speak loudly and clearly, since his voice was being recorded on the tape recorder. A rest period of approximately two to three minutes was allowed before introducing a new sentence. The children often spent this time learning to use the equipment, or chatting with the investigator. The same procedure was employed for all three sentences.

The sentences were presented orally on a Bell and Howell Language Master. They had each been previously recorded on a separate card by a female voice. The child's voice was recorded on a Sony cassette tape recorder. Although a trials to criterion approach was used, testing was discontinued if a child had not reached the criterion

of two perfect reproductions after twenty trials.

The assignment of three sentences in a particular order to each child, was accomplished through a random sampling without replacement technique within each group of six children of the same grade and sex. First, each of the six possible orders of sentences groups A, B, C, were randomly assigned to each of the six children of the same grade and sex. Then, each of the six possible orders of sentence types 1, 2, and 3 were so assigned. The resultant allocations were then paired to form three sentences. Thus each child was presented with three sentences, one from each sentence group, and one from each sentence type.

The testing procedures were modified for the kindergarten children. Only six children were tested -- three girls and three boys. The highly verbal test was found to be somewhat tedious and difficult for children of this age. For this reason, each child heard only ten presentation trials (in lieu of twenty trials) of each of three sentences. Only one child reached criterion on any sentence. Consequently, the kindergarten data were not analyzed statistically, and the kindergarten group is not discussed in the design section below. The recorded transcripts of the kindergarten children offer a rich source of data for the descriptive analysis of the learning process.

DESIGN

The study has a 4 x 2 x 3 factorial design with repeated measures on factor C (see figure 1). There are four levels of factor A (grade), two levels of factor B (sex), and three levels of factor C (sentence type).

FIGURE 1

DESIGN

GRADE	SEX	SENTENCE TYPE		
		1	2	3
1	F M			
2	F M			
3	F M			
4	F M			

A three way analysis of variance with repeated measures was applied to the trials to criterion scores. An analysis of the recorded transcript of the children's learning was undertaken. The results of the statistical analysis and the description of the learning process are presented in chapter IV.

CHAPTER IV

RESULTS

The children's learning of the sentences was analyzed by two methods. Firstly, the trials to criterion scores were submitted to statistical treatment--an analysis of variance was performed on the data. Secondly, individual protocols were examined, and the children's errors were analyzed. Some of the processes involved in the learning of the three types of sentences are described, and the protocols are used for illustration purposes. Finally, the results are discussed as they apply to other empirical and theoretical evidence.

STATISTICAL TREATMENT

The data from the trials to criterion scores are summarized in Table 2 and Table 3. Table 2 is a summary of the three way analysis of variance performed on the trials to criterion scores, and Table 3 displays the mean trials to criterion score for each grade, sex, and sentence-type.

One significant F ratio may be found in Table 2. The sentence-type variable was highly significant ($F=20.20$, $df=2/96$, $p < .0000001$). This indicates that the children learned the type 3 sentences (those which contained no bound morphemes or function words) most rapidly, and found

TABLE 2

SUMMARY TABLE OF THE THREE-WAY ANALYSIS OF VARIANCE PERFORMED ON THE VARIABLES: GRADE, SEX, AND SENTENCE-TYPE

Source	SS	df	MS	F	p
Between subjects	2713.16	47			
A (grade)	350.29	3	116.76	2.34	0.08
B (Sex)	142.01	1	142.01	2.85	0.09
AB	227.58	3	75.86	1.52	0.22
Subject within group	1993.28	40	49.83		
Within subjects	3844.67	96			
C (sentence-type)	1156.76	2	578.38	20.20	0.0000001*
AC	150.68	6	25.11	0.88	0.51
BC	129.59	2	64.79	2.26	0.11
ABC	117.41	6	19.57	0.63	0.66
C x Subject within groups	2290.22	80	28.63		

TABLE 3

MEANS OF SUBJECTS ON ALL VARIABLES

Grade	Sex	Sentence-Type		
		1	2	3
1	Girls N = 6	17.83	17.67	15.50
	Boys N = 6	12.83	18.00	5.83
	Total	15.33	17.83	10.67
2	Girls N = 6	8.83	13.00	8.83
	Boys N = 6	9.50	14.83	9.33
	Total N = 12	9.17	13.92	9.08
3	Girls N = 6	8.17	15.50	10.67
	Boys N = 6	9.50	16.67	5.67
	Total N = 12	8.83	16.08	8.17
4	Girls N = 6	11.33	17.00	10.50
	Boys N = 6	8.67	13.67	4.83
	Total N = 12	10.00	15.33	7.67
Total	N = 48	10.83	15.79	8.90

the type 1 sentences (those with correct English word order) easier to learn than type 2 sentences (where the word order was scrambled). Since type 3 sentences were shorter in length than the other sentence-types, it is not surprising that the children learned them most quickly. The result is that the effect of bound morphemes and function words cannot be properly assessed. The fact that type 1 sentences were easier to learn than type 2 sentences supports the hypothesis that children use the syntactic cue of word order to facilitate their learning of verbal material. Epstein (1961) found similar results with adults. It should be noted that when a child failed to reach criterion on a particular sentence, testing was discontinued after 20 trials; since this procedure was most often employed for the type 2 sentences, these sentences may be even more difficult than the data indicates.

No consistent sex differences were found, but it appears that the boy's performance was somewhat superior to the girls ($F=2.85$, $df=1/47$, $p. < .09$). None of the interaction terms approached significance.

The main effect of grade approached significance ($F=2.34$, $df=3/47$, $p. < .08$). The nature of the developmental trend is best understood by referring to Figure 2. Observation of the graph of cell means in Figure 2 leads to the conclusion that the grade 1 children found the task more difficult than did the students in grades 2, 3, and 4, and that this was particularly true for the type 1 sentences. Indeed, the grade 1 children found the type 1

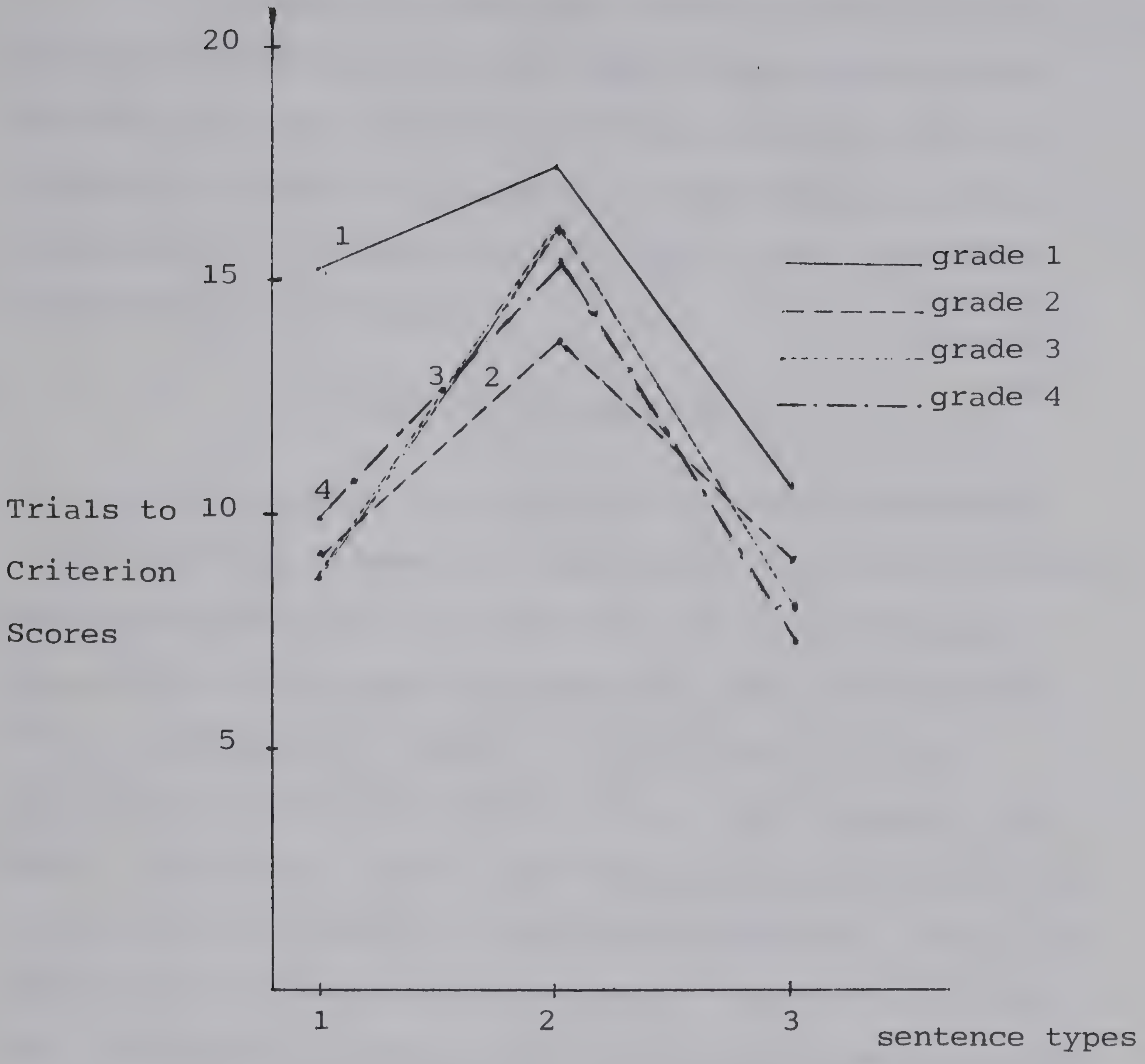

FIGURE 2

MEANS OF TRIALS TO CRITERION SCORES ON SENTENCE-TYPES 1, 2, AND 3 FOR CHILDREN IN GRADES 1, 2, 3, AND 4

sentences to be almost as difficult as the type 2 sentences.

The statistical analysis leads to the conclusion that most grade 1 children do not tend to use syntactic cues to facilitate the learning of verbal material, whereas students in grades 2, 3, and 4 do learn sentences with correct syntactic structure more easily than those with inappropriate word order.

DESCRIPTIVE ANALYSIS

This section is devoted to a general description of the learning process, an analysis of the types of errors made by the children, a delineation of the differences between the three types of sentences, and a description of the developmental trends. The discussion is in qualitative, not quantitative terms. (For example: the number of errors of each type were not counted.) Excerpts from individual protocols are used as examples. Since the fifty-four individual protocols which constitute the raw data are rather lengthy, it would be cumbersome to include all of them in the thesis. Therefore, only five typical protocols (one from each grade) are presented in the Appendix.

The Learning Process

There was a great deal of individual difference in the way the children learned the sentences. A few children learned them extremely quickly - in 2 or 3 trials - whereas others did not reach criterion after 20 trials. Nevertheless

some generalizations about the learning process can safely be made. Many children did not respond in trial 1, i.e. after one presentation of the sentence. Others could only remember one word. A complete inability to respond was particularly prevalent for type 2 sentences, and in children in kindergarten and grade 1.

After 1 or 2 trials most children were able to assimilate the general structure of the sentence. They used the intonation contour as a guide to the learning of this grand structure. For example: one boy in grade 3 gave the following approximation to sentence A2 on trial 1.

(1) Sentence A2 - Hended parf kafally a vegs the.
Approximation - Handed pa Katally a vays the .

Another boy in grade 1 approximated sentence B1 on trial 2 thus:

(2) Sentence B1 - The sivols onuced a wab gozurly.
Approximation - Sivol a nit to wa gozurly.

Simulation of the general rhythm of the sentence was easier in type 1 and type 3 sentences than in type 2 sentences. Here the declarative intonation contour conflicted with the word order and placement of bound morphemes. Hence, many children tended to repeat either the first or last phrase of the sentence for several trials.

Initially, the children omitted and mispronounced words when attempting to repeat the sentences. Very seldom, however, did a child repeat the words he did say in an order which differed from that of the presentation. Furthermore,

omitted words were most often articles (see example 2). The only kind of function word that was presented to the children was articles. Since other kinds of function words were not included in the presentation of the sentences, it is not possible to determine whether function words in general or articles in particular were neglected by the children in their responses. Nevertheless, it is significant that the words which were most frequently omitted are real English words (as opposed to nonsense words) and are function words (as opposed to content words). Omission of words only occasionally occurred in type 3 sentences. Since type 3 sentences consisted of only four words, the entire sentence may have been within the children's short term memory span. In order to maintain a declarative intonation contour, equal stress was placed on each of the four words in presentation trials. In type 1 sentences, as in regular English sentences, stress was placed on the nonsense syllable lexical items (which correspond to content words) as opposed to function words. The children's approximations in the early trials may be compared to the telegraphic speech described by Brown & Bellugi (1964) in their discussion of imitation with reduction (see Chapter II).

Once the child had assimilated the general structure of a sentence, he began to perfect the separate parts. The learning was not a smooth process; the child often forgot on one trial an advance made on the previous trial. The primacy and recency effects that are often in evidence in a

serial order learning paradigm were apparent in the three types of sentences i.e. the children tended to learn the first and last words (or phrases) of the sentence before perfecting the middle part.

A transcript of the protocol of a girl in grade 2 is presented in order to illustrate the above description of the learning process. In this excerpt, the girl was attempting to learn sentence B1.

(3) Sentence B1 - The sivols onuced a wab gozurly.

Trial
1. ________________ (no response).
2. ________________ (no response).
3. Gozurly.
4. Ona ta wa gozurly.
5. This to be ona ta wa gozurly.
6. Tibil ona ta wa gozurly.
7. Tibil ona ta wa gozurly.
8. Festible onible.
9. Tibil ona ta wa gozurly.
10. The sivols ona ta wa gozurly.
11. The sivols onuced a wab gozurly.

In sum, many children began by not responding, and then repeating only one word. (In example (3), the child did not respond for two trials and then recited the word "gozurly" on trial 3.) The general structure of the sentence was often assimilated before individual parts were perfected (trial 4). The word order of the presentation was rigidly maintained, but individual words, particularly articles (function words), were often omitted (the word "the" in example (3).) The learning process was not smooth. forgetting of previous knowledge often occurred (trial 8). The first and last parts of the sentence were often perfected before the middle part (trials 9 to 11), as

dictated by the principles of primacy and recency in serial order learning.

Errors

The children made many types of errors during the process of learning. Probably the most frequent error (and the least important from the point of view of syntractic structure) were errors of articulation. The phrases "swad zalf" (or "swad zalfly") and "onuced a wab" were particularly difficult to pronounce. The words in each phrase were often merged "swad zalfly" became "softly" and "onuced a wab" became "owta wab." Many variations of these phrases appeared in the protocols. Also the letter "f" in "part kafally" was often changed to "t" - "part katally."

Some children associated the nonsense words with English words, and recited these in lieu of the nonsense words as presented. This type of error occurred most frequently in the responses of kindergarten and grade 1 children. For example: one girl in kindergarten gave the following approximation of sentence A1 on trial 10.

(4) Sentence A1 - The vegs hended a parf kafally.
Approximation - The eggs planted by barth kandily.

Some of the children substituted a grammatical sequence, whereas others supplied words with no recognizable syntactic structure. The latter case is exemplified in example (3) trial 5. Errors due to substitution of English words for nonsense words were relatively rare in children in grades 2, 3, and 4.

Anticipatory errors were common in all three sentence-types, as is true of most serial order tasks. The children quite often confused the intial consonants of words. One boy in grade 3 recited sentence A1 thus:

(5) The hegs vended a part katally.

Perseveration may be defined as the persistence of an inappropriate response. This sort of error was prevalent when a child found a sentence extremely difficult to learn. It is impossible to ascertain whether it is the perseveration that interfered with learning or the seeming difficulty of the task which caused the perseveration. Nevertheless, many of the children who perseverated a great deal ceased to attend to the sentence when it was presented, but simply repeated the same incorrect response. A girl in grade one, for example, recited sentence C3 in the following manner for trials 11 to 20.

(6) Sentence C3 - Lurm hanash swad zalf.
Approximation - Lurm hadash swall fall.

Perseveration is a clinical symptom, often associated with brain damage. Rabinovitch & Strassberg (1968) found that poor readers in grade 4 perseverated a great deal when performing a task similar to that of the thesis study. The frequency of this error, however, indicates that in many cases it may merely be a defense which is erected when a task appears to be difficult. The previous response, although incorrect, did not lead to any grave consequences. Therefore, for the child, continuation of this response is presumably a safe method of proceeding.

Errors of omission occurred frequently in the children's responses. The word order of the presentation was rigidly maintained, but often only the first or last half of the sentence was repeated. Although the articles (function words) are the only real English words, they were left out more often than the nonsense words. With the exception of initial trials, words were seldom omitted in type 3 sentences (which contain no function words).

Misplacement of bound morphemes was an error that was almost completely relegated to type 2 sentences. The following example is typical:

(7) Sentence B2 - Onuced wab gozurly a sivols the .
Approximation - Onucly what goes a sivol the.

The above response was given by a child in grade 1 on trial 16, (and with a few variations the sentence was repeated in similar manner from trials 11 to 20). It appears that the child was confused by the conflicting cues related to the syntactic structure of the sentence, thus placing the bound morpheme "ly" on the wrong word. Since "a sivols" is a combination which is impossible in English, the final "s" in "sivols" became the suffix of "go". A boy in grade 3 also made a similar error consistently when learning sentence A2.

(8) Sentence A2 - Hended parf kafally a vegs the.
Handily per kasa a vegs the.

Misplacement of bound morphemes in type 2 sentences occurred extremely frequently at all the various grade levels. Since the child finds it necessary to change cues

which conflict with a pre-conceived schema, it is safe to conclude that the child's knowledge of syntactic structure is deeply ingrained by the age of 5.

Differences Between the Three Sentence Types

Type 1 sentences contained all the features which constitute English syntactic structure declarative intonation contour, correct word order, and bound morphemes and function words. The children used the syntactic cue of word order to organize their learning. The intonation contour helped them assimilate the general rhythm of the sentence. Therefore, articles (function words) were often omitted in the initial stages of learning, and the repetitions resembled the telegraphic speech of young children.

Type 2 sentences contained declarative intonation contour, bound morphemes and function words, and scrambled word order. The incorrect word order provided a conflicting cue and caused these sentences to consistently be the most difficult type to learn. The children attempted to modify the sentences to conform to their preconceived ideas about syntactic structure (as shown by the predominance of errors involving misplacement of bound morphemes).

Type 3 sentences had declarative intonation contour and no function words and bound morphemes. Since the sentences consisted of only four words (as opposed to six words) they were learned most rapidly. Even in the initial trials, the children seldom omitted words. Since in type 1 and type 2 sentences articles (function words) were

generally left out, the lack of errors of ommission in type 3 sentences may be explained by the lack of articles (function words) in the sentences themselves.

Developmental Trends

What are the developmental trends? No striking differences were observed between the children in grades 2, 3, and 4 in terms of rate of learning or process of learning. The grade 1 children found all the sentences more difficult than the older students. This was particularly true for the type 1 sentences, which the grade 1 children found to be slightly easier than type 2 sentences. It appears that correct word order did not facilitate learning in grade 1 children to the extent that it did for the older groups. (This information could not be obtained for the kindergarten children.) Many kindergarten and grade 1 students tended to substitute English words for nonsense words, a type of error which did not occur frequently among the grade 2, 3, and 4's. Perhaps syntactic cues are not as helpful as semantic cues for children who are only beginning to become literate, and the students were attempting to modify the sentences so that they might find cues that would organize their learning.

SUMMARY OF RESULTS

1. The most striking result was the difference in the number of trials to criterion necessary for learning the three types of sentences. Sentence-type 3 was learned

most rapidly, followed by type 1, and type 2 was most difficult to learn.

2. The children in grade 1 were, to a certain extent, an exception to the pattern stated above. The difference in the mean number of trials to criterion for type 1 and type 2 sentences was much smaller than was the case for grades 2, 3, and 4.

3. After the initial trials where no response or one-word responses were prevalent, the children grapsed the general structure of the sentence including intonation, and word order (as presented). Some words, particularly articles (function words) were often omitted. The articulation of the individual words was then perfected. Primacy and recency effects were evident.

4. Articulation, anticipation, and perseveration errors were present in all sentence types at all grade levels.

5. Kindergarten and grade 1 children often replaced the nonsense words with similar English words.

6. Words or phrases were frequently omitted in type 1 and type 2 sentences. Function words (articles) were left out more often than nonsense words.

7. The bound morphemes were often attached to an inappropriate word in type 2 sentences.

DISCUSSION

> Twas brillig, and the slithy toves
> Did gyre and gimble in the wabe
> All mimsy were the borogoves
> And the mome rath outgrabe.
>
> (Lewis Carroll, Jabberwocky)

Children and adults fall in love with this most famous of nonsense verses. What is it that gives this verse its charm and makes it so easy and pleasant to recite? Like the sentences in the study, nonsense word contentives are accompanied by English function words (and some verbs which do not contain a great deal of semantic content). It is similar to the type 1 sentences in that English intonation, word order, and bound morphemes and function words are present. As we have seen, these factors facilitate learning since they conform to a schema which English speaking people have internalized. Lewis Carroll, in addition, has added an admirable choice of nonsense words which are a source of rich associations and provide the poem with powerful semantic content.

The children's superior performance on the type 1 sentences is in agreement with the findings of Epstein (1961, 1962), Miller & Isard (1963), Forster (1966), Rabinovitch & Strassberg (1968), and Singer (1968). It is safe to conclude that adults and children of age 7 and above learn nonmeaningful sentences with all the components of syntactic structure (appropriate word order, intonation contour, and bound morphemes and function words) more easily than non-meaingful sentences where the word order is not grammatical. This conclusion is supported by the children's tendency to misplace the bound morphemes in type 2 sentences in their desperate search for familiar syntactic structure. Type 1 sentences may be thought of

as grammatical sequences, whereas type 2 sentences are not grammatical.

Noam Chomsky (1957, pp. 14-17) analyzed the following two sentences:

(1) Colourless green ideas sleep furiously.
(2) Furiously sleep ideas green colourless.

The difference between the above two sentences is similar to the difference between type 1 and type 2 sentences--the same words are employed, only the order is changed. Sentence (1) is grammatical, whereas sentence (2) is not grammatical. Chomsky stated:

> Presented with these sentences, a speaker of English will read (1) with a normal sentence intonation, but he will read (2) with a falling intonation on each word; in fact with just the intonation pattern given to any sequence of unrelated words. He treats each word in (2) as a separate phrase. Similarly, he will be able to recall (1) much more easily than (2), to learn it much more quickly, etc. Yet he may never have heard or seen any pair of words from these sentences joined in actual discourse.

Chomsky explained that grammaticality cannot be understood on the basis of high probability of prior encounter with the particular sentence nor on the basis of meaning or significance in the semantic sense.

How can children distinguish between grammatical and ungrammatical sequences if not on the basis of prior encounter with particular sentences? To answer this question it is necessary to return to the theoretical discussion in Chapter II. McNeill (1970, pp. 70-72) offered two alternative explanations. Either the child (or LAD) is equipped with a set of universal linguistic

information which he uses as a basis for judgements of grammaticality, or he has the capacity to analyze primary linguistic data and to learn to recognize the features that distinguish those sequences that are grammatical from those sequences which are not grammatical. Once the syntactic structure of the language is assimilated, then the child can use this linguistic information to determine whether a sentence is grammatical. If a sentence contains conflicting syntactic cues, it does not match the schema which had previously been learned, and is thus learned less rapidly. Some of the children attempted to resolve the conflict by attaching the bound morphemes to the wrong word.

The adoption of the second alternative--the child has the ability to discover and learn syntactic structure--is supported by the fact that the kindergarten and grade 1 children did not use the syntactic cues to organize their learning to the same degree as the children in grades 2, 3, and 4. The tendency of the kindergarten and grade 1 children to replace the nonsense words with English words supports the hypothesis that these children were attempting to use semantic cues as opposed to syntactic cues to organize the material and facilitate learning. The children in grade 1 were only beginning to learn to read at the time of testing, whereas the majority of the children in grades 2, 3, and 4 could read. It is interesting to speculate that the effect of instruction in reading may be to increase the child's awareness of the use of syntactic cues to organize

his learning of new verbal material

The ease with which the children learned the type 3 sentences (those without bound morphemes and function words) raises an interesting question: Does the addition of bound morphemes and function words in type 1 and type 2 sentences make them more difficult than type 3 sentences because the resemblance to telegraphic speech is lessened? Telegraphic speech, according to McNeill (1970, p. 72), is similar to the underlying structure in Noam Chomsky's model, and is part of the child's linguistic competence. Although this explanation can account for the fact that type 3 sentences were learned more quickly, and that function words (articles) were usually the objects of errors of omission in sentence types 1 and 2, the author prefers to adopt a more simple explanation. Since linguistic performance is being examined in the study (linguistic competence can only be inferred), psychological factors such as memory span may influence the data. A four word sentence (type 3) is more likely to be within the span of the child's short term memory than a six word sentence (types 1 and 2), and therefore would be easier to learn.

Werner & Kaplan (1963, p. 18) defined the genetic principle of spirality thus:

> At least with regard to humans it must be maintained that with the attainment of higher levels, lower levels of functioning are not lost. Under normal circumstances, such lower levels of functioning (both in terms of means and of ends) are subordinated to more advanced levels of functioning; they may come to the fore again under special internal and external conditions, for example, in dream states, in pathological states, under

> intoxication by certain drugs, or under various experimental conditions. They also, and characteristically, may come to the fore when the organism is confronted with especially difficult and novel tasks: in such cases, one often finds a partial return to more primitive modes of functioning before progressing towards full-fledged higher operations; we may refer to this tendency as a manifestation of the genetic principle of spirality.

The children's rigid adherence to the word order of the presentation (even when the sentences contained scrambled word order) and the frequent omission of function words (articles) in type 1 and type 2 sentences closely resembles the phenomenon of "imitation by reduction". Since type 3 sentences consisted solely of content words, omissions seldom occurred. Brown & Bellugi (1964) observed this "telegraphic speech" in children who were 2 to 3 years of age, and who uttered three or four word sentences. Since this constitutes a return to an earlier mode of functioning to complete a novel and difficult task under an experimental condition, it may be considered a manifestation of the genetic principle of spirality.

CHAPTER V

CONCLUSIONS AND IMPLICATIONS

CONCLUSIONS

The first paragraph of Chapter I was devoted to a series of undefended statements which the author claimed would be substantiated in the course of the thesis. It is now appropriate to demonstrate how this was accomplished in the review of the literature and the report of the study.

> (1) Learning involves more than a particular reaction to a specific stimulus, more than an assimilation of environmental events.

Chomsky (1957, pp. 14-16) demonstrated that grammaticality is not determined by the probability of occurrence of a particular sentence in the corpus of a speaker's language. It is unlikely that the children had previously encountered any of the type 1 or type 2 sentences. Although both types of sentence were of equal length and contained the same words, type 1 sentences were learned more quickly than type 2 sentences. Statement (1) was also confirmed by Bryden (1967), Epstein (1961, 1962), Forster (1966), Miller & Isard (1963), Piaget & Inhelder (1956), Rabinovitch & Strassberg (1968), and Singer (1968) (See Chapter II).

> (2) The learner, whether child or adult, must attend to, order, and organize both the input and his own output. This occurs whether the learning is verbal or nonverbal (perceptual).

In order to learn the sentences, it was necessary for the children to attend to the presentations. Lack of attention often accompanied perseverative errors. The children had to perceive (not on a conscious level) the structure of the sentence. Where this matched a schema which had previously been apprehended, the sentence was easily learned (type 1 sentences). Where this was not the case (type 2 sentences) the children used all the available cues (eg. intonation) to organize the sentence, and attempted to resolve the conflict by placing the bound morphemes on inappropriate nonsense words. For this reason, type 2 sentences were more difficult to learn than type 1 sentences. Statement (2) was substantiated by several studies reviewed in Chapter II. (Since virtually every reference cited illustrates at least part of this phenomenon, a list of authors is not provided here).

> (3) The nature of the interaction between the learner and the object (skill, concept, or fact) to be learned depends on the type of object and the developmental level of the learner.

In the study, the object to be learned was, in all cases, verbal material presented aurally on a language master. Nevertheless, the interaction between the children and the sentences differed according to sentence-type and the age of the child (see Chapter IV). More striking differences were reported on in the review of the literature (Bregman & Wiener, 1970; Brown & Berko, 1960; Entwisle, 1966; Epstein, 1961, 1962; Forster, 1966; Gottschalk, 1965; Luria, 1961; McNeill, 1966, 1970; Miller & Isard, 1963; Piaget &

Inhelder, 1956; Rabinovitch & Strassberg, 1968; Singer, 1968; Vygotsky, 1962; Werner & Kaplan, 1950; Werner & Kaplan, 1963).

> (4) This interaction is influenced by sensory, motivational and cognitive factors, and by social and cultural factors.

Only one part of this last statement is directly substantiated by the study itself, the whole statement reflecting the theoretical context in which the study was done. In the study, motivational, social, and cultural factors were controlled as much as possible. The children approached the three sentence-types somewhat differently. Presumably, previous cognitive sets influenced their perception of the material as presented, leading to the different rates and ways of learning the three types of sentences. Noam Chomsky (1965) and McNeill (1970) claimed that the cognitive sets represent the speaker-hearer's intuitive knowledge of the syntactic structure of his own language which is derived from a body of linguistic information which is universal. According to Noam Chomsky and McNeill, this knowledge of syntactic features is innate. As stated above, the author considers this knowledge to be learned through prior interaction with primary linguistic data. Perceptual learning is probably involved in the process.

Noam Chomsky deals with language as a formal system, only considering the case of an idealized speaker-hearer. The model generated as a result is not sufficient for the educational psychologist who is interested in the language

development of children whose actions are affected by cognition, motivation, their perception of sensory stimuli, and the interaction between these three factors. In Chapter II, a basis for the study of language development in this context was presented. In terms of phylogenesis, the organization of stimuli progressively occurs at higher levels, and is more profoundly affected by motivational and cognitive factors. At early levels, the organism is virtually determined by his environment, whereas in man, "the environment is not only reacted to and acted on but is cognized or 'known' in the form of perceptualized and conceptualized objects" (Werner & Kaplan, 1963, p. 9). Man's brain is functionally differentiated into three blocks. The first (the midbrain) is concerned with arousal, motivation, and emotion. The second block (the occipital, temporal, and parietal lobes) receives sensory signals, codes, organizes, and interprets these signals, and integrates coded communication from several sources. The third block (the frontal lobe) is involved in the overall grand planning of behavior (Luria, 1970). Luria showed how each of the three blocks plays a major role in almost every type of behavior, particularly in complex actions such as speech or writing.

Bernstein (1967) demonstrated how social and cultural factors influence the language development of children. The mothers of middle class children tend to speak in fairly long, complex, and grammatical sentences--

an elaborated linguistic code, whereas lower class mothers are usually confined to a restricted code involving gesture, monosyllabic grunts, and short simple sentences. Therefore, the quality of the primary linguistic data encountered by lower and middle class children differs considerably. Lower class children are often deficient in many areas of language development. Blank & Solomon (1968) claimed that the children lack a "symbolic system by which to organize the plentiful stimulation surrounding them". Whorf (1965) hypothesized that the structure of a language profundly affects the culture of a group. The author prefers to postulate a dialectical relationship between language, and social and cultural factors. They constantly interact with each other, affecting the individual in diverse ways. Suggestions for further research which would illustrate the interaction between social and cultural factors and the child's use of syntactic structure are given below.

IMPLICATIONS

During the course of carrying out the study, the author became aware of some limitations both in the design of the study and the range of permissable generalization of the results. The limitations in design are outlined first, followed by a discussion of the theoretical implications for language development and practical implications for language instruction. These limitations and the theoretical and practical conclusions drawn from

the review of the literature and the study have implications for further research.

Sentence-length was not completely controlled for, since type 3 sentences contained fewer items than type 1 and type 2 sentences. Therefore, the role of bound morphemes and function words could not be adequately ascertained. This limitation could be recitified by the addition of a fourth sentence-type equal in length to the type 1 sentence, but containing no bound morphemes or function words.

The sentences in group A were consistently learned more quickly than the sentences in groups B and C. Although the selection of three sentences (from the nine) and the order of presentation was done by a randomization procedure (see Chapter III), the sentences A1, B2, and C3 were presented most frequently. In order to determine whether the significant difference in the trials to criterion scores of sentence-types 1, 2, and 3 were not due to this factor, a two-way analysis of variance with sentence-type and sentence-group as independent variables was performed on the trials to criterion scores. Using a randomization procedure for casting out scores, the number of children in each grade receiving each of the nine sentences was equalized. There still was a highly significant difference between the sentence-types ($F = 12.82$, df = 12/63, p. $<$ .0001). The interaction between sentence-type and sentence group was not significant ($F = 0.45$, df = 4/63, p. $<$ .77). Therefore,

the difference in difficulty of the three groups of sentences did not affect the sentence-type differences. Nevertheless, from the point of view of replication of the study, it would be wise to select sentence-groups which are approximately equal in difficulty. Further complications may be avoided by equalizing, rather than randomizing, the distribution of sentences in each grade.

As is well illustrated by the poem Jabberwocky, the use of nonsense words does not ensure that a sentence is devoid of semantic content. (This factor can only be controlled for through the use of a phonemic array which differs from that of English. This, however, would render the sentences extremely difficult to pronounce). The pace of the presentation and response trials was rapid. In only a few instances did the children in grades 2, 3, and 4 appear to associate the nonsense words with English words. This error occurred quite frequently in kindergarten and grade 1.

The descriptive analysis of the data was not expressed in quantitative terms. The nature of the learning process, the analysis of the types of errors, the differences between the three types of sentences, and the direction of the developmental trends were only determined by careful inspection of the data. Many of these factors can be verified quantitatively. For example: it is feasible to compute utterance-length per trial, construct serial position curves, and count the number of errors of each type. These

dependent variables could then be compared across grade, sex, and sentence-type. The data from this sort of quantitative analysis would either confirm or disprove the results presented in the descriptive analysis.

The purpose of the study was to establish a developmental base-line. The results may be generalized only to the population from which the sample was selected, i.e., English speaking children of middle socio-economic status who are in the normal range of intelligence.

Adults use the syntactic cue of word order to facilitate the learning of English sentences with syntactic structure (Epstein, 1961, 1962; Forster, 1966). The results of the present study indicate that children between the ages of 7 and 9 also tend to organize their learning of sentences through the cue of word order. This is also supported by the findings of Rabinovitch & Strassberg (1968), and Singer (1968). Six-year-old children, however, do not tend to use these syntactic cues to the same extent as older children. Noam Chomsky (1965) and McNeill (1970, pp. 70-72) state that the features which constitute syntactic structure are universal, a part of LAD, and thus an innate component of children's linguistic competence. The author maintains that the child only has the capacity to discover these syntactic features (see Chapter II) and his competence consists of universal procedures of analysis. Chomsky's and McNeill's position implies that children between the ages of 3 and 5 use syntactic cues to facilitate the learning

of verbal material to the same extent as older children. The author hypothesizes that the tendency to use these cues decreases with decreasing age. An extension of the present study to 3 to 5 year-old children (employing shorter sentences and a more engrossing game procedure to compensate for short attention span and distractibility) would help resolve the two positions.

Children in grade 4 who were poor readers, who functioned in the normal range of intellectual ability, and who were of middle socio-economic status did not use the syntactic cue of word order to organize their learning as much as good readers of the same age, intelligence, and socio-economic background (Rabinovitch & Strassberg, 1968; Weinstein, 1968). According to Singer (1968), both good and poor readers (in grade 4) of lower socio-economic status learned sentences with syntactic structure more rapidly than sentences in which the word-order was random. In all these studies, the individual differences in the rate of learning and the use of syntactic structure to facilitate learning were large. Is an inability to use syntactic structure to organize the perception and learning of verbal material a manifestation of a greater inability of some children with learning disabilities and of some mentally retarded children? These questions can only be answered by further research.

The children who participated in the study were from a middle socio-economic area. According to Bernstein (1967),

the parents of these children speak to them in an elaborated linguistic code involving long complex sentences with many syntactic cues. Lower class children would be more likely to be exposed to a restricted code consisting more of monosyllables, gestures, or of sentences which are short, simple commands. Further research is necessary to determine whether socio-economic status affects the child's opportunity to discover the syntactic structure of sentences and use these cues to facilitate learning. Possibly, one of the North American Indian child's difficulties is that he is not exposed to sufficient grammatical English speech to properly internalize the syntactic structure of the language. The cues inherent in agglutinated language are very different from those of English. Since learning of new verbal material is less rapid when the syntactic structure of the language is not internalized, Indian and culturally different children may be educationally handicapped in this regard.

In Canada, second language instruction often commences in kindergarten and grade 1. Some investigators believe that this is the optimum period for learning a second languate (Penfield & Roberts, 1959). There are large individual differences in children's ability to learn a second language. Similarly, much individual variation in the ability to use syntactic cues to facilitate learning was evident in the study. It is interesting to speculate that the ability to employ syntactic structure for this purpose may be related to the ability to easily become proficient in a second language. Perhaps a refined version

of the test used in the study may prove to be a good instrument for assessing the ability to become fluent in a second language. Of course, these speculations can only be tested by further research.

Prior to school entrance, learning is usually a spontaneous, self-initiated activity. In the primary grades of school, most children encounter formal instruction in reading and language for the first time. It is likely that one of the effects of school instruction is to make the child more aware of those elements of language which may be used as an organizational framework on which the learning of new material is based.

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APPENDIX

The children's attempts to learn the sentences were tape recorded, and the oral responses were transcribed into written form. Since reproduction of the protocols for each of the 54 children would require much space, five protocols were selected, one from each of kindergarten, grades 1, 2, 3, and 4, for inclusion in the thesis. In spite of the variation among the children, the author attempted to choose protocols that are representative.

KINDERGARTEN

Subject: 5 Age: 5.9

Sex: M IQ: 109

Totals: A1 10+
B2 10+
C3 10+

Sentence A1 - The vegs hended a parf kafally.

Trial	Approximations
1	The pegs went far happily.
2	The pegs went far happily.
3	The pegs wented happily.
4	The pegs went up happily.
5	The pegs planted happily.
6	The vegs planted happily.
7	The vegs wented far happily.
8	The pegs wented var happily.
9	The vegs went fartly happy.
10	The vegs went far happily.

Sentence B2 - Onuced wab gozurly a sivols the.

Trial	Approximations
1	- - - - - - - - - - - - - -
2	The wolf went happily.
3	The sivolers that.
4	A sivols that.
5	The gozurla sivols that.
6	The gozurla sivols that.
7	Gozurla sivols a that.
8	The gozurla sivols a that.
9	Gozurla sivols of that.
10	Gozurla sivols a that.

Sentence C3 - Lurm Hanash swad zalf.

Trial	Approximations
1	The worth lover that.
2	Lurth loves a that.
3	A worm loves glup.
4	The word a wa wa.
5	The word long glup.
6	Lurm a wa wa.
7	The word la.
8	The word la the.
9	The word laugh on a.
10	The word laugh on them.

GRADE 1

Subject: 6 Age: 6.6

Sex: F IQ: 105

Totals: B1 20+
C2 20+
A3 20+

Sentence B1 - The sivols onuced a wab gozurly.

Trial	Approximations
1	Senate twa gonaty.
2	Seven to go wonaty.
3	- - - - - - - - - -
4	The seven to go wonaty.
5	The seven to go wonaty.
6	The seven to go wonaty.
7	The seven to go wonaty.
8	The seven to go wonaty.
9	The seven to go wonaty.
10	The seven to go gozurly.
11	The sevens to on gozurly.
12	The sevens to owe on gozurly.
13	The sevens to owe wonaty.
14	The sevens to owe wonaty.
15	The sevens to owe gozurly.
16	The
17	The sevens to owe gozurly.
18	The owe gozurly.
19	The sevens to owe gozurly.
20	The sevens to owe gozurly.

Sentence C2 - Hanashed swad zalfly a lurms the.

Trial	Approximations
1	- - - - - - - - - -
2	Hello soft learning.
3	Hello soft learning vile.
4	Hello a soft learning vile.
5	Hello softly the lurm vile.
6	Hello softly a lurm dial .
7	Hanashed a hell.
8	Hello a soft learning vile.
9	Hello softly the lurm that.
10	Hello.
11	Hanashed the.
12	Hello softly the lurm that.
13	Hello softly the lurm than.
14	Hello softly the lurm that.
15	Hello softly the lurm that.

Sentence C2 - Hanashed swad zalfly a lurms the.(Continued)

Trial	Approximations
16	Hello softly the lurm.
17	Hello softly the lurm that.
18	Hanashed.
19	Hello softly the lurm than.
20	Hanashed softly lurm than.

Sentence A3 - Veg hend parf kafal.

Trial	Approximations
1	Bay head par rattle.
2	Bay head hard kattle.
3	Beg head hard kattle.
4	Veg hend hard kattle.
5	Vay head par kattle.
6	Vay head hard kattle.
7	Veg head kard kattle.
8	Veg head hard kattle.
9	Veg head hard kastle.
10	Vay head kart kattle.
11	Beg
12	Beg hen kart kastle.
13	Beg head kart kattle.
14	Veg hend kart kattle.
15	Veg head kart kattle.
16	Beg hen kart kattle.
17	Veg head parf kattle .
18	Veg head kart kattle.
19	Veg hend.
20	Veg head part kattle.

GRADE 2

Subject: 6 Age: 7.6

Sex: F IQ: 111

Totals: A2 4
C3 6
B1 13

Sentence A2 - Hended parf kafally a vegs the.

Trial	Approximations
1	- - - - - - -
2	Hended part katally a vegs the.
3	Hended part katally eggs the.
4	Hended parf kafally a vegs the.

Sentence C3 - Lurm hanash swad zalf.

Trial	Approximations
1	- - - - - - -
2	Lurm ha wish.
3	Lurm han wish.
4	Swa the.
5	Lurm hanash zalf.
6	Lurm hanash swad zalf.

Sentence B1 - The sivols onuced a wab gozurly.

Trial	Approximations
1	- - - - - - -
2	- - - - - - -
3	- - - - - - -
4	Ona
5	Sivols
6	A wa glo.
7	Sivols awaglo.
8	Sivols on wa.
9	The sivols onwa.
10	The sivols onwa gozurly.
11	The sivols onwa gozurly.
12	The sivols onwat gozurly.
13	The sivols onuced a wab gozurly.

GRADE 3

Subject: 9 Age: 8.6

Sex: M IQ: 105

Totals: C1 9
A3 5
B2 5

Sentence C1 - The lurms hanashed a swad zalfly.

Trial	Approximations
1	The hands.
2	The lurms hanashed the shwans solly.
3	The lurms hanashed the swans zolly .
4	The lurms hanashed zaltzy.
5	The lurms hanashed the swans zaltzy.
6	The lurms hanashed the swad zaltzy.
7	The lurms hanashed a hands zaltzy.
8	The lurms hanashed a swads.
9	The lurms hanashed a swad zalfly.

Sentence A3 - Veg hend parf kafal.

Trial	Approximations
1	Aye hend par hattle.
2	Veg pend hard kattle.
3	Veg hend par kattle.
4	Veg pen par haffle.
5	Veg hend parf kafal.

Sentence B2 - Onuced wab gozurly a sivols the.

Trial	Approximations
1	Wanis a govally sivols a.
2	Wan as wa govally sivols a .
3	Wanas a govally sivols the.
4	Onuced wa gozurly sivols the.
5	Onuced wab gozurly a sivols the.

GRADE 4

Subject: 12 Age: 9.0

Sex: M IQ: Nonverbal 111
Verbal 119

Totals: A1 4
C2 9
B3 4

Sentence A1 - The vegs hended a parf kafally.

Trial	Approximations
1	hegs - - -
2	The hegs hended a part kafally.
3	The hegs herded a part kafally.
4	The vegs hended a parf kafally.

Sentence C2 - Hanashed Swad zalfly a lurms the.

Trial	Approximations
1	Hanna lurm softly.
2	Hanna softly a lurm that.
3	Hanna softly ad lurm that.
4	Hanna lurms softly.
5	Hanna ha softly a lurm that.
6	Hanna was softly and lurm the.
7	Hanash sa.
8	Hanash was softly a lurms the.
9	Hanashed swad zalfly a lurms the.

Sentence B3 - Sivol onuc wab gozur.

Trial	Approximations
1	Sivic onuc wab gozur.
2	Sivic onuc.
3	Sivol onuc gob gozur.
4	Sivol onuc wab gozur.

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